

Operating System

6. Operating System

6.1 Introduction

An Operating System (OS) is a program that acts as an intermediary between the user of a computer and computer hardware. OS simplifies and manages the complexity of running application programs efficiently. Operating system simplifies the execution of user programs and makes solving user problems easier.

Operating System is system software, which makes a computer to actually work. It is the software that enables all the programs we use. The OS organizes and controls the hardware. Without an operating system computing device is of no use. Operating system is required on many devices containing a computer like mobile devices and video game consoles to web servers and supercomputers. Examples of Desktop Operating system include Microsoft Windows, Mac OS, Linux, UNIX etc. and Mobile operating systems include Android, Windows, IOS, Symbian etc.

The structure of computer system consists of 3 layers:

1. **Hardware:** It consists of CPU, Main memory, I/O Devices, etc.
2. **System Software:** Operating system is a component of System software and it includes process management routines, memory management routines, I/O control routines, file management routines
3. **Application Software:** These are the programs which are accessed by users through a graphical user interface as per user needs and need operating system to function.

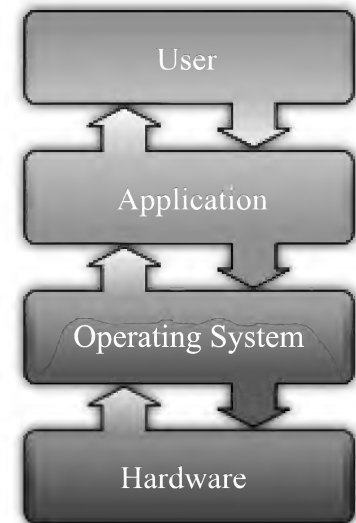


Figure 6.1: Structure of Computer system

OPERATING SYSTEM OVERVIEW

The Layers Of A System

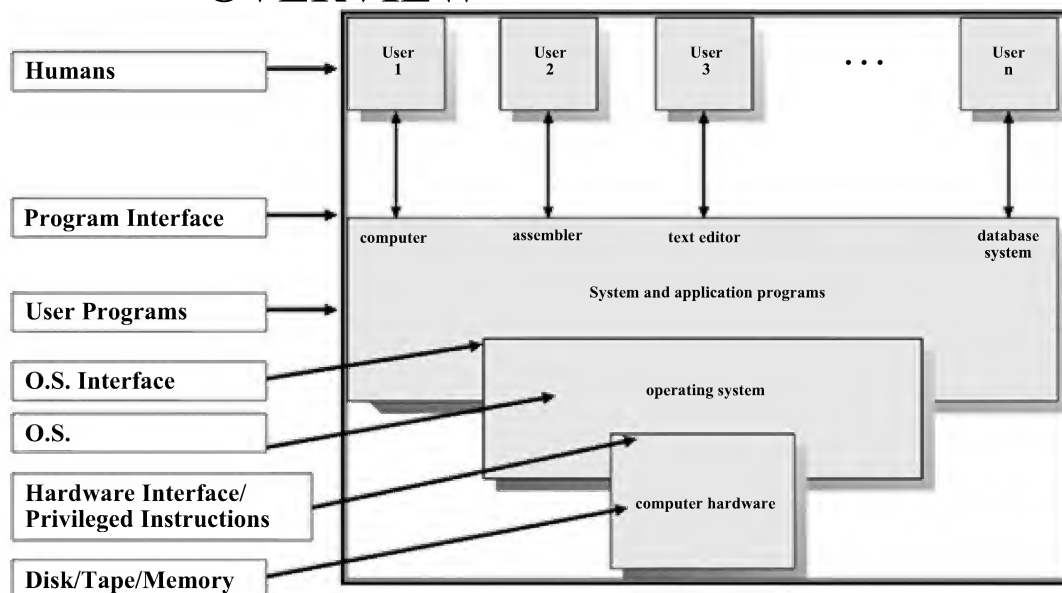


Figure 6.2: Operating System

6.1.1 Functions of an Operating System

Main functions of an operating system are:

- **Resource management:** Operating systems coordinate all the resources required for computing which includes Memory Management, Processor Management, Device Management, File Management etc. An operating system performs basic tasks such as, controlling and allocating memory, prioritizing system requests, controlling input and output devices, facilitating networking and managing file systems, allows sharing of hardware and software resources; makes application software portable and versatile; provide isolation, security and protection among user programs; improve overall system reliability; error confinement, fault tolerance, reconfiguration.
- **Interface between Application and Users:** OS acts as an interface for end users.
- **Program Execution:** OS acts as an interface between the application programs and the machine hardware.

6.1.2 Type of Operating Systems

Embedded Operating System

These operating systems are for embedded computer systems like handheld computers or devices like PDAs and smartphones. These are also known as Real-time Operating Systems. Windows CE is one of the popular examples of embedded OS.

Network Computer Operating System

The operating systems are used in a network of computers linked together and they allow shared file/printer access among multiple computers and enable sharing of data, users, applications and other networking functions typically over a LAN or private network. Examples of these types of OS are Netware, Windows XP Server, Dell Network OS etc.

Desktop Operating System

It works on single computing device. Mac OS, Windows 10 etc. are examples of Desktop operating systems.

QUICK REVIEW

- What are different types of OS?
- What are the functions of an OS?
- Difference between system & application software?

6.2 Graphical User Interface (GUI) and Command Line Interface (CLI)

Graphical user interface is an interface that allows users of an electronic device to interact with it using graphical icons and visual indicators as opposed to text based or command based navigation in case of Command user interface. Examples of GUI include modern versions of Windows, Linux and Mac etc. (Windows 10 being the latest version) whereas old version MS DOS, UNIX etc. are examples of command line interfaces.

With a graphical user interface modern windows OS versions provide the capability to carry out many varied operations of benefit to the user like:

- WISYWIG: What You See Is What You Get – the image on the screen (text or otherwise) should be an exact image of what you will see on paper
- Image scanning: Instant visual representation of the scanned image on screen and so instant feedback from the user
- Processable Graphics: Applications such as Photoshop and Fireworks as image manipulation packages.
- Animations and support for multimedia: Now a very wide application area ranging from visually oriented teaching resources to touch-sensitive information kiosks.
- Provision for users with disabilities: Configuring desktop interfaces for visually impaired,

background colors to provide sharper contrast

Windows interface also known as Graphical User Interfaces (GUIs). It is either mouse-driven or icon-based. Windows are allocated to the use of a particular program or process and contain a title bar, menu bar, and widgets.



Figure 6.3: GUI

MS-DOS/Windows UNIX/Linux

| | | |
|---------------------|--------------|--|
| dir | ls | List a directory of files or get information about files |
| copy | cp | Copy a file from one place to another |
| move | mv | Move a file from one place to another |
| del or erase | rm | Delete (remove) a file |
| type | cat | Type a file out to the screen (or redirected to a printer) |
| mkdir | mkdir | Attach a new subdirectory to the tree at this tree junction |
| rmdir | rmdir | Delete a subdirectory |

Figure 6.4: Command line interface of Linux

6.2.1 Advantages and disadvantages of GUI

Advantages: In general GUI OS users can readily operate the computer and feel more in control and not intimidated by it. User learning time is short – does not take long to open the box, assemble the kit and start to do productive work. With prompts and alerts and mouse movements and double-clicking on objects, etc. users get instant feedback on their actions. Mistakes can be more readily detected than with command line interfaces and they can be more easily corrected. Once you have learned to use one WIMP (Windows, Icon, Menu, Pointer) based operating system then it is simpler to transfer those skills to using a different OS e.g. Mac OS.

Disadvantages: Graphical user interfaces need large amounts of memory and fast processors to display the images and manipulate them interactively. Skilled users feel that they can accomplish tasks using fewer steps than with a GUI e.g. copying a file – CP <oldfilename>, <newfilename>. Users with certain disabilities (vision/motor) can still have trouble using GUIs. Screens can easily become cluttered and difficult to navigate.

6.2.2 Advantages and Disadvantages of CLI

Advantages: CLI is more flexible and powerful. It is faster for experienced users and can combine commands. It is easy to implement. It required less hardware/software. Software is less complex and easy to write.

Disadvantages: It is more difficult to learn and use. It requires more training to understand.

Command should be remembered to do work on CLI based system.

QUICK REVIEW

- What is the difference between GUI and CLI?
- What are advantages and disadvantages of GUI & CLI?

6.3 Windows 10: Introduction

Windows 10 is the latest version of personal computer operating system developed by Microsoft. It is a part of the Windows NT family of operating systems and is a successor to Windows 7 and 8.1 versions. It was officially released on July 29, 2015.

Earlier popular versions of Microsoft Windows include Windows 8/8.1, Windows 7, Windows Vista, Windows XP, Windows ME, Windows 2000, Windows 98, Windows NT, Windows 95 and MS DOS.

6.3.1 Understanding Windows 10 User Interface

Bootting a Computer: Starting or restarting a computing device is called booting. A cold boot is process in which a computer starts from a powerless state. Rebooting a computer through key combinations or menu is known as Warm Booting.

Desktop Area: The desktop is the area that appears right after logging in. It contains a background picture (wallpaper), icons and the taskbar. You can copy as many shortcuts as you want onto it, change its background image, and do many other things.

Taskbar: Windows user interface is characterized by a bar at the bottom of your screen (it may be moved to another edge by left-mouse-clicking on it and dragging it to the desired edge while continuing to hold down the mouse button). This bar is called the "taskbar." It includes "Start menu" (which contains shortcuts to applications stored on your hard drive)

Icons: Tiny picture that represents a program, folder, or program function. On the desktop are pictures with text labels under them, these pictures are called icons because they represent something else. Icons usually represent programs, but sometimes they represent collections of data. Double-clicking on one of these icons will open whatever it represents.

System Tray: The system tray holds icons for programs currently running in background. Over on one side of the task-bar is a clock; beside the clock are a bunch of icons that represent open 'invisible' programs. This area is called the system tray. On the main part of the task-bar there is sometimes a small group of icons, this is called the quick-launch bar. Clicking on one of these icons opens whatever it represents.

The quick-launch icons are also buttons. Some buttons are raised to look like real buttons and

some only rise up when you put the cursor on top of them. The button on the other side of the start-bar from the clock and system tray is called the start-button. When you click the start-button it opens the start-menu. The start-menu has icons for more programs and data collections, although it is usually programs.

Shortcuts Icons: that are only links to the things those icons represent. The icons that are on the desktop, the quick-launch bar, and the start-menu are usually shortcuts. On the desktop shortcuts are often indicated by a small symbol on top of the icon. Icons represent all data collections and programs even if they are not shortcuts, however normally the ones on the desktop and in the start-menu are shortcuts.



Figure 6.5: Windows 10 Desktop

USEFUL TIP

There is a difference between icon and shortcut. An icon is any picture that is meant to convey what something is. The icon on the start-button represents the fact that it is a major part of Windows, which is why it is a Windows logo. Shortcuts are a link to a program or data collection; the icon on a shortcut represents whatever the shortcut opens, however the same icon would be on the real thing as well.

Start menu: Start menu was not available in Windows 8 and 8.1 is back in Windows 10, with some improvements, including a space you can personalize with your favorite apps, programs, people and websites. To get to the Start menu, select Start in the lower-left corner of the taskbar. You can also open the Start menu by pressing the Start button located on your keyboard or device.

- **Account options:** By clicking on account name, you can change your account picture, lock your device or sign out of your account.
- **Power:** By clicking on this button you can put your device to Sleep mode or shutdown the device or restart it.
- **Quick links and frequently used apps:** On the left side of the Start menu, you'll find quick

links to PC settings, Documents and File Explorer at the top. The section just below that lists your most recently used apps and programs. If you see an arrow next to a program, you can move your mouse over it to see a list of your recently used files for that program.

- **All apps:** By Clicking on All Apps you can see all your apps and programs listed alphabetically. Looking for a specific app? Just type it in the search box.
- **Search:** You can search across your device, your cloud storage on OneDrive, and across the Web at the same time. Simply open the Start menu and type in the search box. You can also open search directly from the taskbar; click Search and start typing. Search button can also be used to get any kind of help regarding Windows 10. You need to just type the keyword or question and relevant links will be displayed for you.

Pin your favorite apps: Pin apps, programs and folders to the Start menu for fast access to the things you use the most. Apps with Live Tiles will show updates for the people and things that matter. Click Start, select All Apps, right-click the app you want to pin, and then select Pin to Start. Once pinned, your app will show up as a tile on the right. Right-click the tile to change its size. Drag and drop to move it around. Don't worry about running out of space — the Start menu will automatically resize to hold everything.

USEFUL TIP

Seeing an arrow to the right of an app? Select it to see app-specific tasks or items.

Windows Explorer/File Explorer

The window that appears when you open a folder is called windows explorer or file explorer.

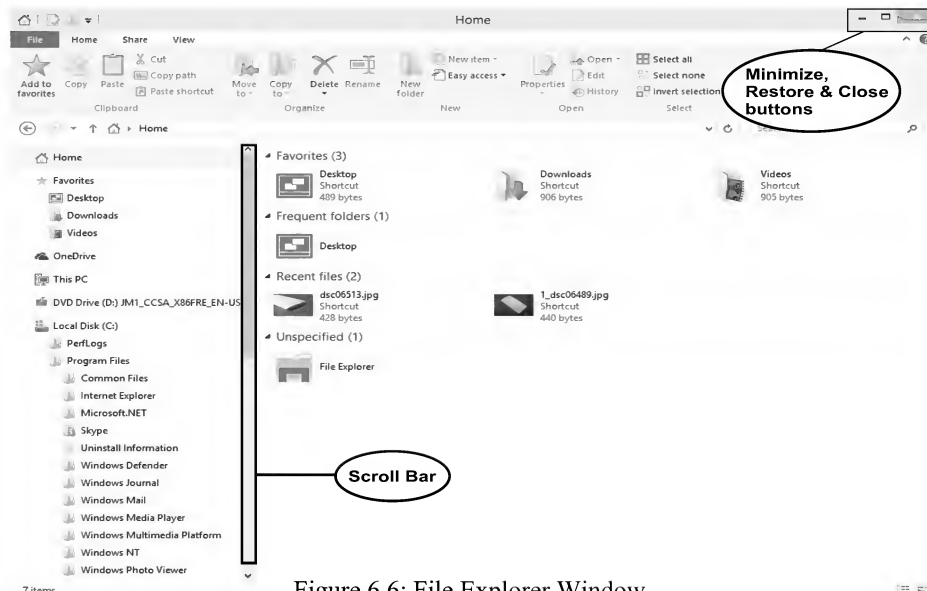


Figure 6.6: File Explorer Window

Task view: if you have a lot of apps and programs open, there is a new Task view button so you can

quickly switch between them. Click Task view to see all of your running apps and programs; select any item to open it.

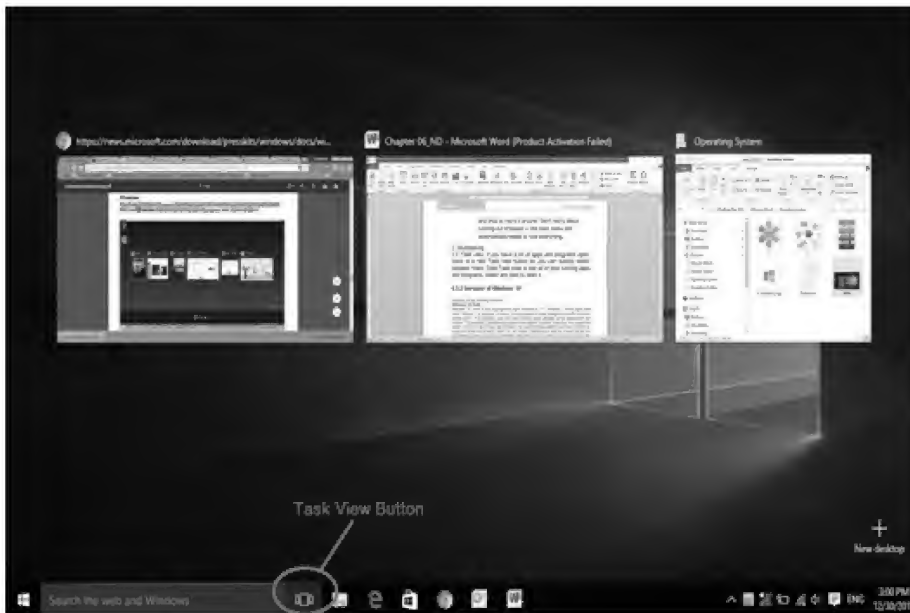


Figure 6.7: Task View Button

USEFUL TIP

There is a difference between Multitasking and multiprocessing. Multitasking is a method where multiple tasks/processes share common processing resources such as CPU whereas multiprocessing is a processing mode which simultaneously processes two or more programs or routines by use of multiple CPUs.

Multiple desktops: If you're working on a lot of different projects, using different apps and programs, try adding a desktop. It'll keep things neatly organized for you. Or, create a desktop for the things you do at work and one for the things you do at home. Select Task view from the taskbar, and then click Add a desktop. A thumbnail will show up at the bottom of the task view page. Click the blank thumbnail to open up a clean desktop. To switch between desktops, you can click Task view and then choose a desktop from the bottom of the page.

Microsoft Edge: Internet Explorer has been replaced by Microsoft Edge Browser in Windows 10 as default browser. Microsoft Edge is the first browser that lets you take notes, write, doodle, and highlight directly on webpages. Use the reading list icon to save your favorite articles for later, and then read them in reading view icon. Hover over open tabs to preview them, and bring your favorites and reading list with you when you use Microsoft Edge on another device.

Windows Store: You can download music, videos, games, and apps from Windows store. Icon is located on the taskbar.

Cortana: Microsoft voice powered personal assistant has been launched with Windows 10 OS. Cortana can be configured to take over the search box.

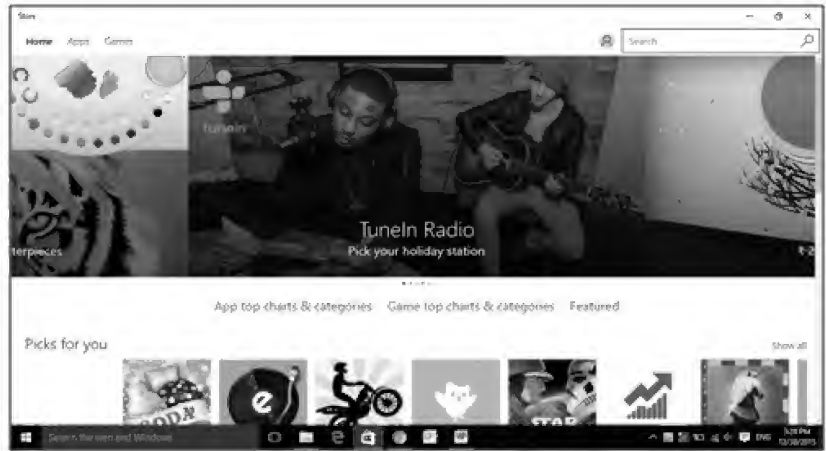


Figure 6.8: Windows Store

QUICK REVIEW

- What operations can you do using Start Menu?
- What is the use of Taskbar?
- What are the different types of Icons in Windows 10?

6.4 Windows 10: Control Panel & Software Installation

User can modify many aspects of Windows and intermediate users will have access to all the options they need to control their computer. Mastering the workings of the Control Panel can be considered as necessary to become a seasoned Windows 10 user.

6.4.1 Windows 10 Control Panel

The Control Panel can be opened either by right clicking Start Button or by typing Control Panel in Search Box.

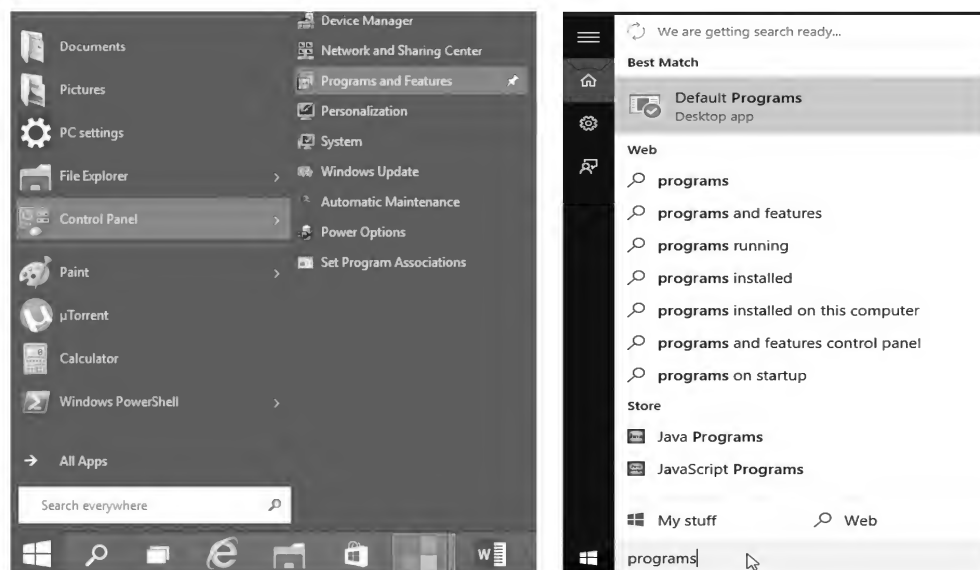


Figure 6.9: Control panel in menu

The Control Panel contains an address bar and search box like many other folders. The different commands are categorized into eight groups:

System and Security - This section deals with the overall operation and stability/security of Windows 10. Here, you can open the Action Center, check system settings, manage Windows Update settings and power consumption options, and access other administrative tools like Action Center , Windows Firewall, System, Windows Update, Power Options, Backup and Restore, BitLocker Drive Encryption, Administrative Tools

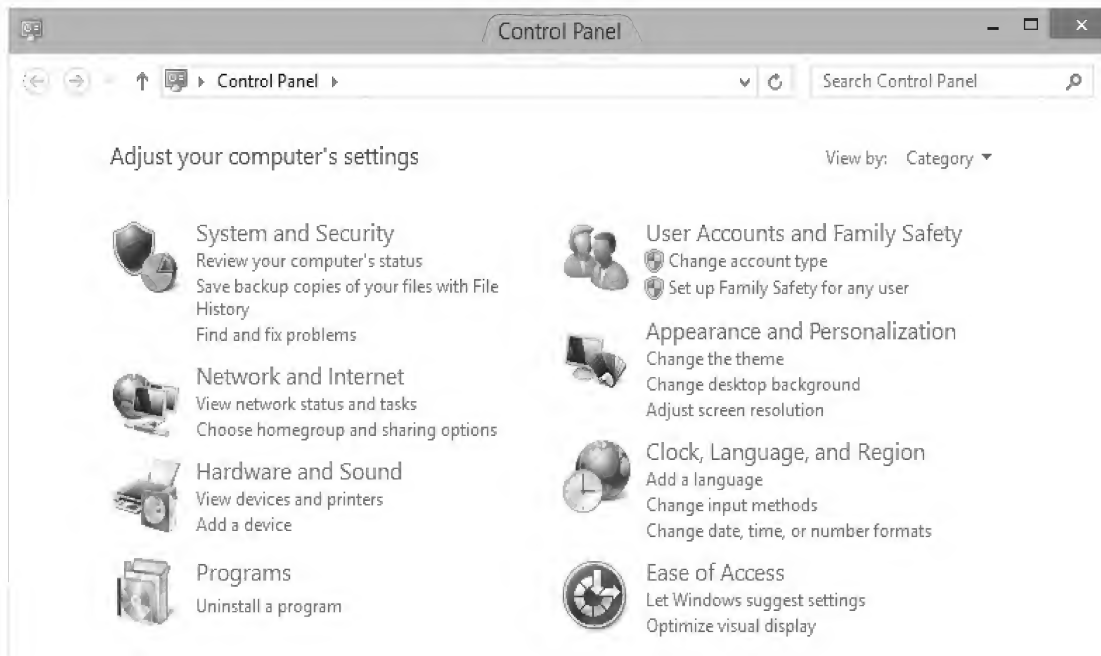



Figure6.10: Control Panel

New button called **Settings** is also available in Windows 10 for faster and efficient personalization as per the user. You can get to Settings by selecting the Start  button, and then selecting Settings. From there, browse the categories or use search to find what you're looking for, including advanced options in Control Panel.

6.4.2 Software Installation

Windows 10 comes equipped with some basic software that will satisfy the

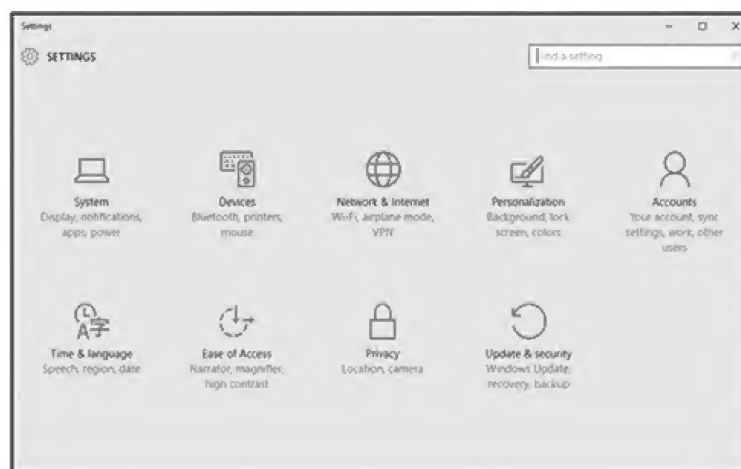


Figure 6.11: Settings Window

needs of most novice users. You can browse the Internet, listen to and watch digital media, produce word processing documents, etc. However, there are many varieties of programs that aren't included with operating systems because the cost and size of the operating system would get out of hand in a hurry. Installing your own programs might sound intimidating, but it really isn't. The programs designed to work with Windows are usually very easy and methodical to install.

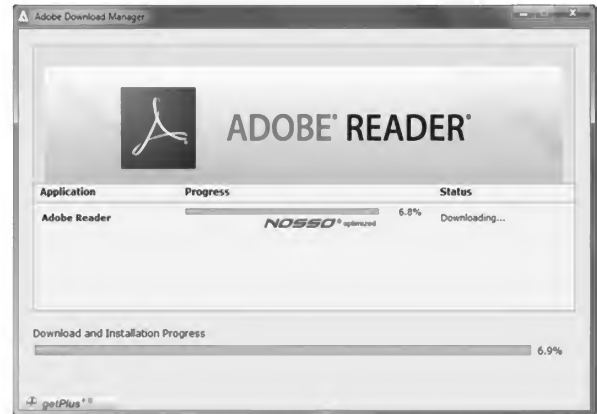


Figure 6.12: Software Installation

As an example, let's install a program that is used to view PDF files (Portable Document Files). A company called Adobe Systems created this file format. First click on exe file of adobe and it will be asked to allow this program to make changes to your computer. Click yes to proceed. Eventually you will see a window showing you the download and installation progress:

Once the installation is complete; close the installation window. The program is now ready to use. You will see an icon on your desktop and a new entry in the Start menu. Double-click the desktop icon or click the Start Menu icon to open and use the program.

For most users, simply clicking the Next button will install the program with all of the default settings. Once you have completed all the setup requirements, click Install or Finish to make the installation program go to work. Some products will require you to restart your computer in order to finalize the installation. This will clear any temporary files from memory and update any files that were in use. You are now ready to use the program.

Driver: A device Driver (commonly referred as a driver) is a program that operates and controls the device that is attached to computer like printer, scanner, CD ROM drive etc. Installation of external devices will sometimes require installation of device specific drivers.

QUICK REVIEW

- How to change date and time on Windows 10?
- How to change Screensaver and Background?
- How to change mouse properties?

6.5 Windows 10: Working with Files & Folders

A file, or document, is a collection of data that has a name and is stored in a computer. We can organize files by storing them in folders. Disks contain folders that hold documents, or files in Floppy disks, Zip disks, Compact Discs (CDs), Hard Disks and these disks can be removed or

inserted in a drive.

Windows organizes the folders and files in a hierarchy, or file system. Windows stores folders and important files that it needs when you turn on the computer in the root directory. Folders stored within other folders are called subfolders.

The type of disk you use to store files determines how you organize those files. Storing files on removable media allows you to use simpler organization. The larger the medium, the more levels of folders we can should use-My Documents folder or we can should have a backup, or duplicate copy, of important files.

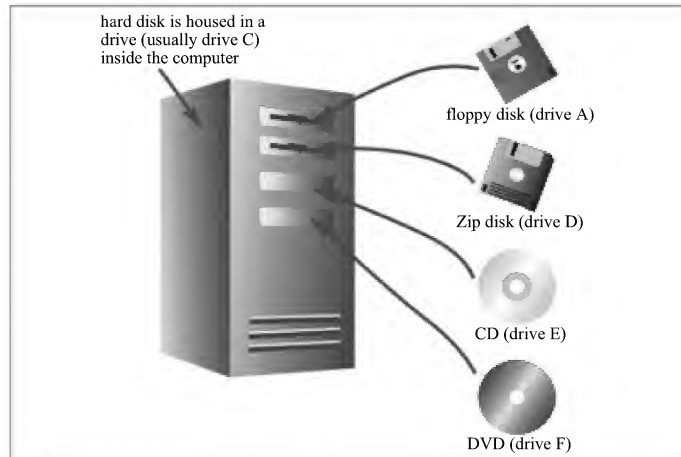


Figure 6.13: Managing the files

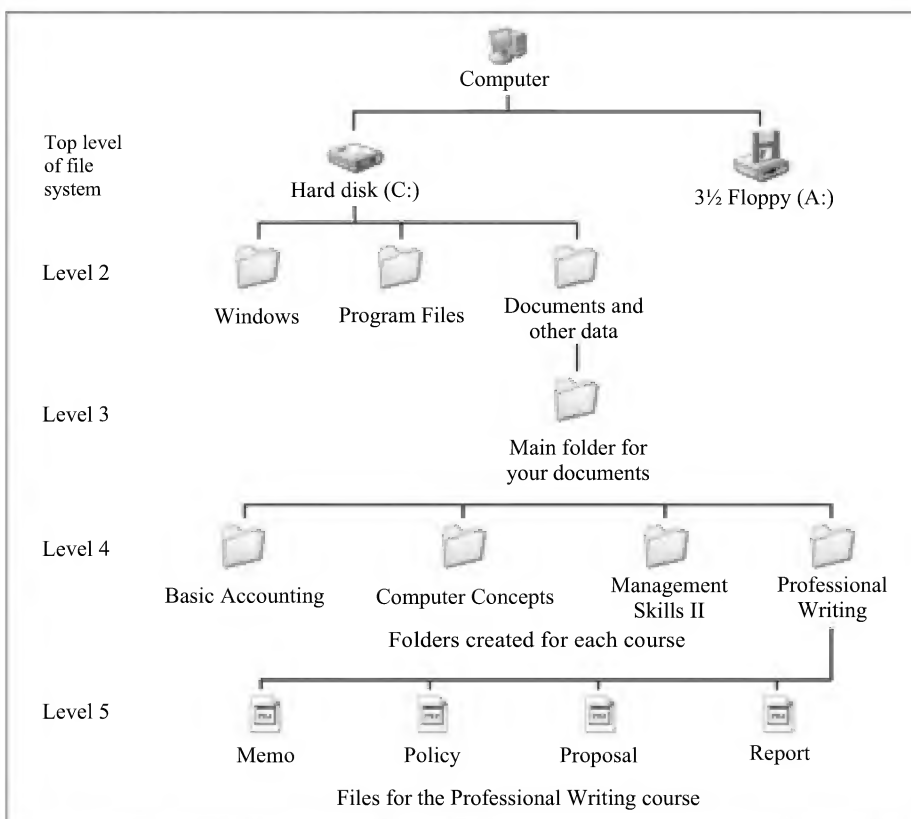


Figure 6.14 : Managing files in windows

Windows Explorer shows the files, folders, and drives on your computer-Panes: Explorer bar, Folders pane, Expand icon, Collapse icon. My Computer shows the drives on your computer.

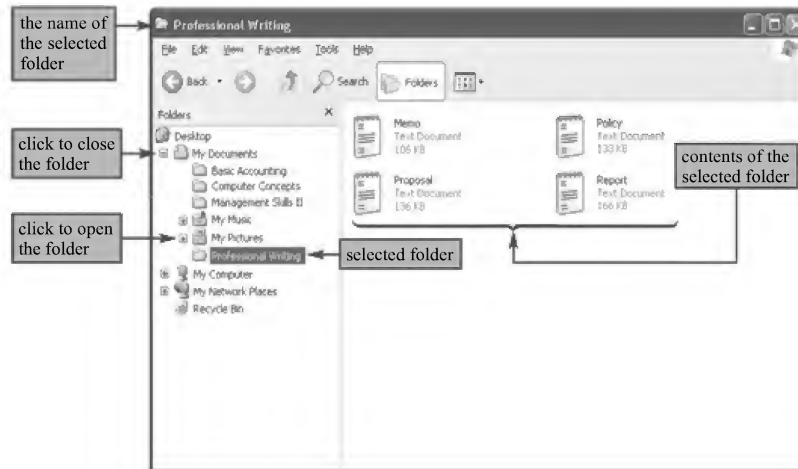


Figure 6.15: Working with folder

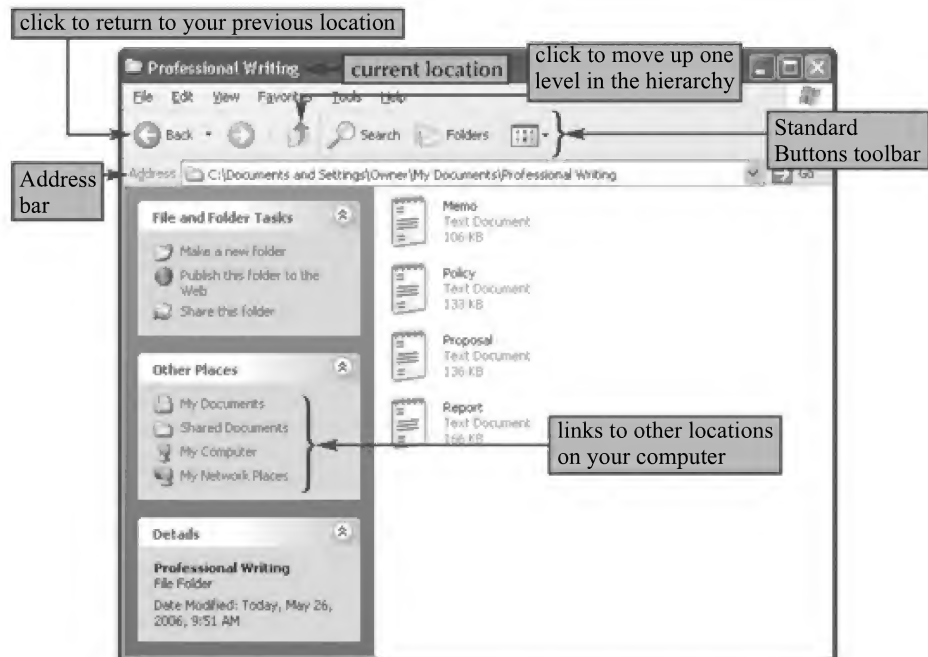


Figure 6.16: Managing folders in windows

The file path is a notation that indicates a file's location on your computer

A:\FM\Tutorial\Holiday.bmp

- 1 A: is the drive name
- 2 FM is the top-level folder on drive A
- 3 Tutorial is a subfolder in the FM folder

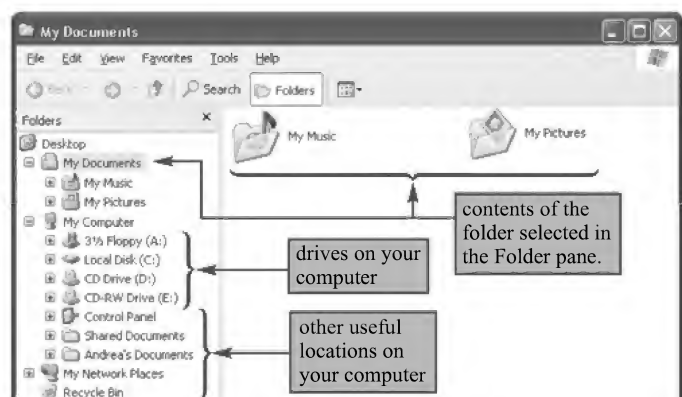


Figure 6.17: My Documents folder in windows

- 4 Holiday.bmp is the full filename with the file extension

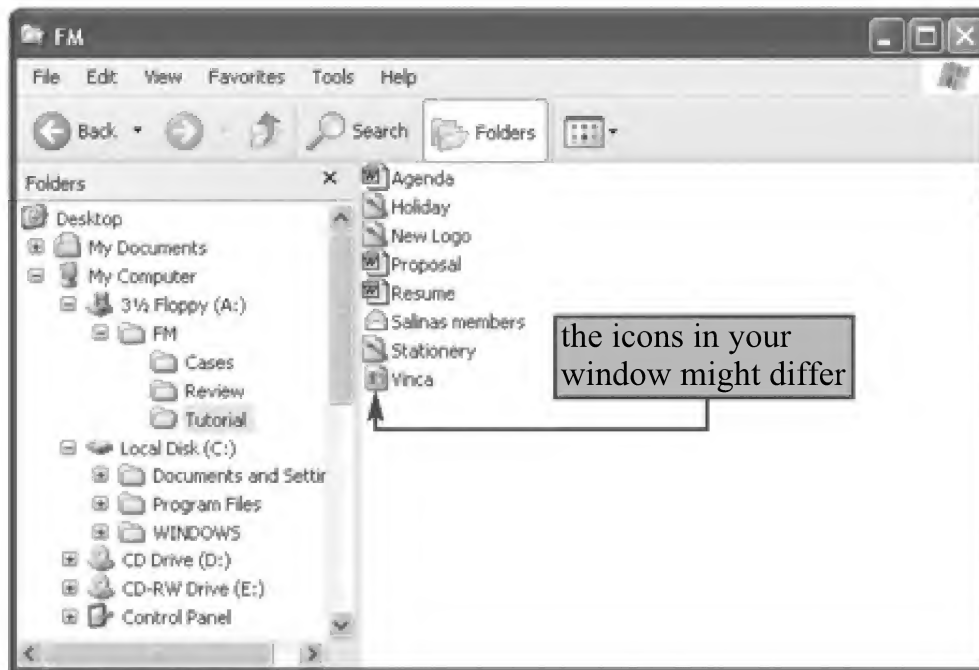


Figure 6.18: Managing different files in windows

We can create Folders using Windows Explorer. Click File on the menu bar, point to New to display the submenu, and then click Folder.

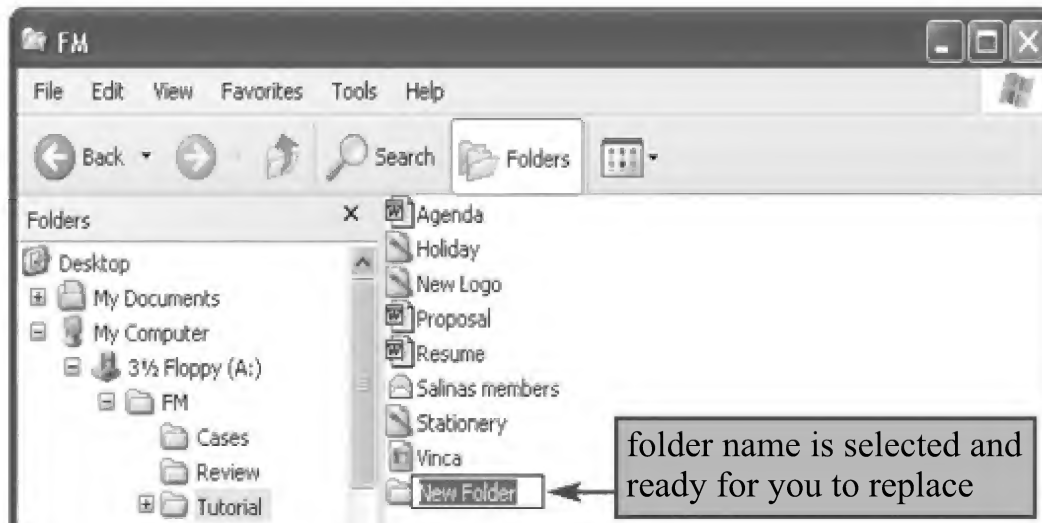


Figure 6.19: Folder name in Windows 10

We can move and copy Files and Folders. Moving a file removes it from its current location and places it in a new location you specify. Copying places the file in both locations

We can name and rename the files. Filenames provide important information about the file, including its contents and purpose—Main part of the filename, Dot, File extension. A filename extension identifies the file's type and indicates the program in which the file was created.

use the expand and collapse icons to navigate your computer



Figure 6.20: Expand and collapse icons in windows 10

Recycle Bin: This folder provides temporary storage for files and folders that you delete. A user cannot access the file/folder after deleting it from recycle bin.

USEFUL TIP

Using “Shift+Delete” keyboard keys permanently deletes the file/folder and it is not even available in Recycle bin.

QUICK REVIEW

- What is the difference between file and folder?
- What is the path of a file/folder saved on desktop?
- What is the use of Scroll bar?

6.6 Windows 10: Basic Applications/Utilities

Windows 10 has in-built basic applications/utilities. Utilities Programs manage, repair, and optimize data on a computer. A basic set comes with every OS. Accessories can be accessed by typing its name in Search box available on Taskbar. Some are as follows:

Calculator: You can use Calculator to perform simple calculations such as addition, subtraction, multiplication, and division. Calculator also offers the advanced capabilities of a programming, scientific, and statistical calculator.

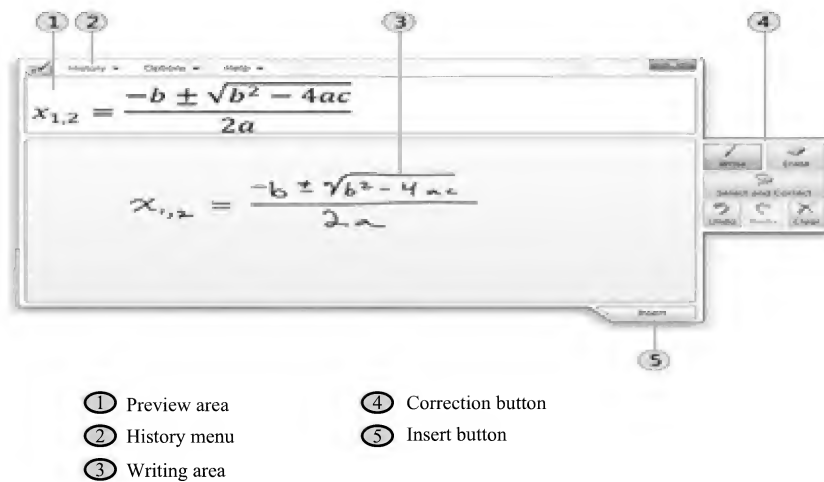


Figure 6.21: Math tool in accessories in Windows 7

Math Input Panel: If you use your computer to solve math problems or to create documents or presentations that have typed mathematical expressions in them, Math Input Panel makes the process easier and more natural. Math Input Panel uses the math recognizer that's built into Windows 10 to recognize handwritten math expressions. You can then insert the recognized math into a word-processing or computational program.

Math Input Panel is designed to be used with a tablet pen on a Tablet PC, but you can use it with any input device, such as a touchscreen, external digitizer, or even a mouse. To open Math Input Panel, press on tab in accessories menu. Write a well-formed math expression in the writing area. The recognized math is shown in the preview area. Make any necessary corrections to the math recognition. Tap Insert to put the recognized math into your word-processing or computational program.

Snipping Tool: You can use Snipping Tool to capture a screen shot, or snip, of any object on your screen, and then annotate, save, or share the image. You can capture any of the following types of snips:

- Free-form Snip. Draw a free-form shape around an object.
- Rectangular Snip. Drag the cursor around an object to form a rectangle.
- Window Snip. Select a window, such as a browser window or dialog box that you want to capture.
- Full-screen Snip. Capture the entire screen.

Windows Mobility Center

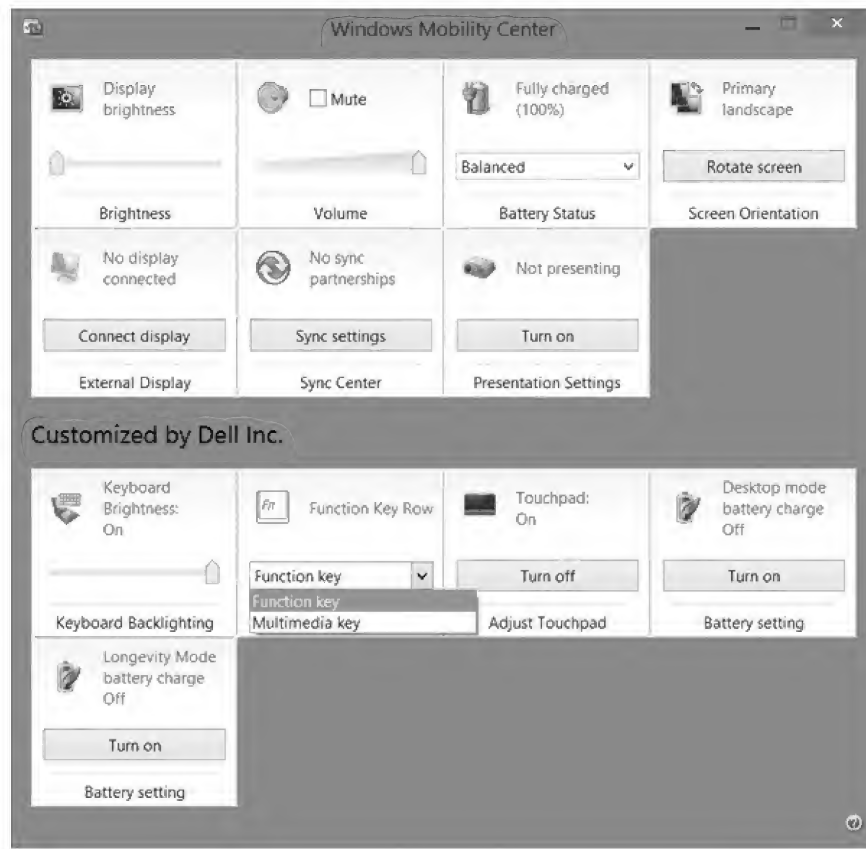


Figure 6.22: Windows Mobility Center in Windows 10

If you use a laptop, you can quickly access settings (for example, speaker volume, wireless network connection status, and display brightness) in Windows Mobility Center. Because all these settings are in one location, you save time and don't need to remember where each setting is located.

To open Windows Mobility Center, click on windows mobility Center in accessories menu. Mobility Center displays the most commonly used laptop settings, such as brightness, volume, battery status, and wireless network status. Different tiles are displayed depending on your system, and some tiles are added by your laptop manufacturer.

Here are some of the settings you might find in Mobility Center. Remember that not all settings are available on all laptops.

- **Brightness:** Move the slider to temporarily adjust the brightness of your display. To adjust the display brightness settings for your power plan, click the icon to open Power Options.
- **Volume:** Move the slider to adjust the speaker volume of your laptop, or select the Mute check box.
- **Battery Status:** View how much charge remains on your battery or select a power plan from

the list.

- **Wireless Network:** View the status of your wireless network connection or turn your wireless network adapter on or off.
- **Screen Rotation:** Change the orientation of your Tablet PC screen from portrait to landscape, or vice versa.
- **External Display:** Connect an additional monitor to your laptop, or customize the display settings.
- **Sync Center:** View the status of in-progress file sync, start a new sync, set up a sync partnership, or change your settings in Sync Center.

Paint: Paint is a drawing program you can use to create drawings or edit digital pictures. You can also use Paint to save picture files using different file formats

System Tools: Through System tools, unnecessary files on hard disk can be deleted and disk can be defragmented to improve system performance significantly. Disk Defragmenter tool and Disk Clean-up tools can be used for this.

QUICK REVIEW

- Which accessories are available in Windows 10?
- What is the use of Disk Cleanup and Defragmenter?
- What can be done using Math Input Panel?

Multiple Choice Questions

1. Identify false statement:
 - a. You can find deleted files in recycle bin
 - b. You can restore any files from recycle bin if you ever need
 - c. You can increase free space of disk by sending files in recycle bin
 - d. You can right click and choose Empty Recycle Bin to clean it at once
2. Which of the following operating system is not an example of Graphical User Interface?
 - a. Windows 8.1
 - b. MacOS
 - c. Linux
 - d. Unix
3. Which is not application software?
 - a. Windows XP
 - b. VLC Media Player
 - c. Adobe Reader
 - d. Photoshop
4. A small part of taskbar that has icons of background running applications and has date and time displayed on it is:
 - a. Start button
 - b. Quick launch
 - c. Task bar
 - d. System tray
5. Which of the following operating system does not implement the multitasking ?
 - a. Windows 98
 - b. Windows NT
 - c. Windows XP
 - d. MS DOS
6. Which of the following Windows do not have Start button:
 - a. Windows Vista
 - b. Windows 10
 - c. Windows 8
 - d. None of above
7. Which of the following is not an operating system?
 - a. DOS
 - b. Linux
 - c. Windows
 - d. Oracle
8. A _____ is a named location on a disk where files are stored:
 - a. Folder
 - b. Pod
 - c. Version
 - d. File Group
9. In Windows, start button can be used for:
 - a. Launching applications
 - b. Device settings
 - c. Turning off the system
 - d. All of above
10. Whenever you move a directory from one location to another:
 - a. All files inside the directory are moved
 - b. All the subdirectory inside that directory are moved
 - c. The directory is moved the source file is not moved
 - d. Both a and b